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THE ELEMENTARY SCHOOL AND INDUSTRIAL OCCUPATIONS

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In view of the fact that 90 per cent. of the population begin to earn a living at the age of fourteen, the demand seems reasonable that the manual-training course in our elementary school concern itself first of all with preparation for more intelligent choice of vocation; aiming both to discover mechanical tastes and aptitudes, and to impart knowledge regarding the relative advantages of different industries. It is true that when a boy reaches the right shop he will surpass in a few weeks the skill which he has acquired at school, but the important and the difficult thing is to have him reach the right shop. That the conventional course accomplishes this in certain cases is of course a matter for congratulation, but the question is whether it is accomplishing one-fifth or one-tenth of what it might.

The question arises at once as to the value of interests and abilities which may be discovered before the fourteenth year in determining vocation. No one denies that in many individual cases these early tendencies have proved to be totally misleading, but some types of aptitude, like that for music, make themselves known in early childhood, and there is much to indicate that mechanical talents and interests appear early, if at all. In a study made by the writer, of the boyhood of a large number of leading engineers, it was found that the great majority of them were absorbed almost from infancy in mechanical interest of one sort or another and have displayed remarkable ability in mechanical work—coupled in many cases with noticeable lack of either interest or ability in such foreign subjects as history and literature. And further, these early interests often showed very close relation to the special line of success in later life. Many of the mechanical engineers had built working steam-engines in boy-

hood, while the play of great electricians had been with telegraph relays, dynamos, and telephones.¹

Every teacher of manual training knows boys from ten years of age upward who had been failures in school and enigmas at home, but, on entering the shop emerged into a new life, and worked there with a persistence and interest amazing to parent and principal. One such may develop an initiative which suggests a future engineer, while another is so dependent on oversight as to promise no more than the journeyman grade of ability, but the suggestion gained regarding vocation is equally valuable to both pupils, and the school is rendering a most important service in developing such interest in the industrial life.

Industry, however, is not one but many. It demands from its workers a great variety of talents, mental and motor. Psychology and experience unite in assuring us there is really no such thing as "mechanical ability," but rather a multitude of mechanical abilities, and these scattered in a most promiscuous way. Frequently, of course, one person proves to be endowed with a group of them but it is always dangerous to prophesy which ones will appear together. They may appear singly or in almost grotesque combinations. That a boy, therefore, lacks enthusiasm for bench work in wood, even when supplemented perhaps by work in decorating leather and in hammering copper, by no means stamps him as one of the non-mechanically minded. He may easily prove a first-class plumber, electrician, or even machinist, not to mention a host of other specialized trades.² Consequently the school should make persistent efforts to open up these other industries to its pupils, if only in a crude way, and in spite of obvious lack of equipment and of classroom time.

¹ *The Constructive Interests of Children*, pp. 58-65.

² The writer's experience in an evening trade school has furnished frequent illustration of this. Boys were constantly applying to "learn a trade" with not the slightest notion of trade-preference (there was no manual training whatever in their schools) and again with a purely a-priori bias for electricity. These were encouraged to experiment upon themselves in one course after another, and some who had been the despair of the instructor in pattern-making appeared later as the shining lights in electrical construction. Others who had been completely bewildered by the electrical work found themselves thoroughly at home in the foundry room.

No selection of industries for such study can have general application since attention should of course be focused upon the important local industries. The proper group for Pittsburg would be wholly out of place in Grand Rapids. The following list, however, contains the topics which in the writer's opinion would be most frequently appropriate:³

Machinery: Its operation, adjustment and repair.

Metal-working: The foundry and machine shop.

Woodworking: The requirements of carpentry, cabinet making, pattern making, and the planing-mill.

Electricity: Bells and simple circuits, telegraph, structure of motor.

Building trades: Carpentry, masonry, plumbing, structural iron work, reinforced concrete construction.

As to time-allowance and mode of treatment, the writer's thesis is that anything at all will be better than nothing at all. At least there may be a brief discussion of such occupations with explanation of the general conditions of work in each, i. e., their desirability in regard to wages, hours, and seasonal fluctuation,—ways of learning the trade, the time required, opportunities for later advancement, etc. The processes of the industry may be illustrated with photographs, magazine illustrations, and trade catalogues. Frequently, however, the teacher will take his class to visit the industry itself. Such visits should involve an actual study of the industry, including discussions beforehand of the things to be noted and explanations afterward of the things seen and of their interrelations.⁴ Still further, some of these indus-

³ Agriculture should appear in this list, of course, but for the fact that the school is accustomed to dealing with it as nature-study rather than as manual training.

⁴ The value of such work is supported in an interesting way by the testimony of a number of eminent engineers in the study mentioned above. To quote from four of them:

1. "My actual work was undoubtedly an incentive to apply my decided taste for mechanical work later, but it was rather watching mechanics at their work that led me on. I spent my boyhood time in such ways constantly—whole days in engine rooms of mills, etc.—but I actually made and finished few things of importance, if any."

2. "In my own case I feel that my constant love for seeing machinery at work, and learning by questioning and observation the what and why of things, had most to do with my taking up engineering."

tries may be effectively reproduced in miniature by the pupils within the school shop. This is the ideal conclusion for such a study, giving to the pupils an actual feeling of the materials and actual experience in solving some of the problems involved and of discovering and overcoming one obstacle after another which had escaped their notice when they were simply looking on at the work of others. Such reproduction, by boys of twelve and fourteen years, crowded into the compass of a few lessons, will necessarily be a greatly simplified affair, and the results will be exceedingly crude, but this is not a serious objection, provided that some elementary problems of the trade or industry in question are faced and solved in a fairly typical way, not in a merely imitative fashion. To illustrate: the study of carpentry through making cardboard houses would be purely imitative while the building of a properly braced house frame out of laths would be more nearly typical.⁵

Machine-sense, under modern conditions, seems a fundamental industrial asset. Ability to understand, operate, adjust or repair machinery is doubtless a determining element in the success of the great majority of workers who rise above the level of unskilled labor, and as all machines have so much in common, the study of machinery probably comes the nearest to being a "general mechanical training." In visits to factories the various devices for the transmission of power and motion should receive attention as well as the successive transformations of the product. Then, in the manual-training room, a more intensive study of mechanisms is entirely practicable. The lock on the door, for instance, is always at hand for dissection before the class, and

3. "I was fond of watching the machinists in the factory and spent as much time there as I was allowed, with the result of quickening my power of observation until I had the faculty of carrying in my mind complex mechanisms."

4. "What I consider of eminent importance for the future engineer would be much observation especially if it can be done under a competent teacher. With a bright student this develops into a comprehensiveness that can never be overvalued." Pp. 71-3.

⁵ For detailed accounts of such industrial studies see Richards, "The Thought Side of Manual Training," *Manual Training Magazine*, December, 1902; McNary, "A Study of Transportation," *Teachers' College Record*, VIII, 57-66; Wahlstrom, "Industries in the School," *Proceedings E. M. T. A.*, 1906, pp. 89-105.

many other examples, such as toy steam engines, old clocks, sewing-machines and bicycles,⁶ may be analysed in the same fashion. The making by the pupils of mechanical projects like waterwheels, windmills, and various moving toys is also of course a most desirable phase of such a study.

Foundry work, electrical construction and plumbing should each have some attention, not only because of the large number employed in these lines but because they make use of such radically different kinds of ability, both mental and manual. Plumbers earn excellent wages, but they seldom surprise with the fine quality of their woodwork, and probably many of them could never be taught to do good woodwork. The molder requires delicacy of touch, while the electrician's main need is not manual dexterity but is a mind that can pick its way rapidly through tortuous circuits and connections. A great variety of electrical tinkering may be done in the shop at small expense, and small wooden molding-flasks made in the shop may be used extensively even at home in the making of castings from lead. In all of the more concrete and experimental studies it should be borne in mind that it is the whole industry which is being studied, and care should be exercised in keeping prominent the relationship between an entire industry and the part which has been selected for reproduction.

The suggestions thus far offered concerning subject-matter have assumed both the conventional time-allowance of one lesson per week, and the conventional organization which treats all elementary pupils exactly alike. That much can be accomplished under these conditions has been proved by a number of schools. The question must arise however whether a course that is not excessive for the less mechanical pupils can be at all adequate for the more mechanical. As Professor Kennelly has shown,⁷ almost any course of study may be either vocational or cultural,

⁶ The bicycle seems a peculiarly fortunate combination of mechanical-movements, adjustments and resistances to strain. It would be interesting to know how many machinists were first faced toward their careers by the experiences which it furnished them in boyhood.

⁷ "The Basis of an Effective Education," *School Review*, May, 1907.

according to the vocational purpose and interest of the pupil. The work outlined above will have a certain vocational value for the mechanically minded pupils while for the others its value will be cultural. But the boy who is destined for industry needs a larger time-allowance, so that while getting the general view of the industries he may also have contact, as adequate as his age will permit, with the different types of work. He needs the actual experimenting with tools and materials,—which should rather be called experimenting with himself and his own abilities.

The idea of an elective course of any sort in the public schools is certain to be unpopular, and it is true that the programme of the regular teacher might be complicated by its introduction. Still it seems to the writer that the situation is one which must be met sooner or later by the formation of special classes. The possibility of holding such special classes outside of regular school hours at once suggests itself. There are obvious objections to such a plan, but the writer has seen it carried out quite effectively. The classes, which met twice a week in the late afternoon, were open to the sixth and seventh grades of one public school. They were taught by the same teacher who had the manual work of these entire grades within school hours, and were attended by 30 per cent. of the boys belonging to these school grades, with a rate of absence very low for any type of voluntary course—3 to 10 per cent.

This experiment under typical public school conditions indicates that such work is a strongly preferred form of play for the more mechanical third or fourth of the school population, and suggests opportunities of which the school should not be slow to take advantage.

Thus far we have been considering the boy under fourteen years of age—the boy under legal obligation to attend school. In turning now to the case of the boy who has passed fourteen, a glance is necessary at further conditions which govern his entrance into gainful occupation. The investigation of the Massachusetts commission furnishes our best data.

The commission concluded that the average boy leaves school at fourteen, not so much from economic necessity as from lack

of interest in the course of study now offered to him; that this feeling is due sometimes to mere impatience of books and craving for a more active life, sometimes to the inability to see how the work of a year or so more in school would be of any real value to him, either personal or vocational; that while in many cases the parents require or demand the boy's wages after fourteen years, more often his going to work is against the protest of parents who would prefer to have him remain there longer.

While the school does make a real effort by moral suasion to retain its pupils, it is possible that comparatively small changes in curriculum and course of study might be far more effective. We are justified in believing that more emphasis upon manual and industrial training would be the most effective single means toward a lengthening of the school life.

It seems to the writer that special courses may be offered by the elementary school for the benefit of this pupil without requiring any serious readjustment of school programme or of the work offered to other pupils. Such a special class could occupy two or more of the afternoon school sessions per week. Its enrollment should probably be limited to boys who have passed fourteen years of age—boys upon whom the school has no further legal hold. It should presumably be placed before the pupil as an inadequate substitute for a secondary course, and none need be admitted except upon evidence of inability to afford or to profit by the conventional high-school course, and upon written permission from parents.

The work in this course might relate to a number of industries or it might be confined to one, according to local conditions. In either case it could of course be much more thorough, systematic and technical than the work given previously and should therefore make a much clearer contribution to industrial intelligence and efficiency. Pupils taking this course would continue for the remainder of the time in the regular school classes, the programme being so arranged that they would drop the whole of certain subjects rather than parts of different subjects. The more important subjects would naturally be confined to the forenoon, and in these no distinction would be made between special

and regular pupils. The dropping of certain subjects would of course mean giving up the high school, but the provisions already suggested would prevent entrance to the special course except by those just on the verge of leaving the school; and for these both the industrial training and the additional drill during the forenoon upon the fundamentals would be just so much clear gain.

In conclusion it may be well to make more explicit the thought that the suggestions which have been set forth do not contemplate new schools nor even new shops. All the plans proposed seem to the writer to belong naturally within the curriculum of the elementary school and to interfere in no way with its present organization. All the work proposed seems to him practicable within the elementary manual-training equipment—somewhat supplemented. Three steps have been suggested to increase the contribution of manual training to industrial efficiency: that the present work should aim primarily at developing intelligence in vocational choice; that special classes should be provided outside of school hours for the specially apt pupils under fourteen years of age; that special introductory trade classes within school hours should be provided for those between fourteen and sixteen who cannot look forward to secondary training. All such opportunities, it may be added, seem especially necessary in our present situation, but there is every reason to believe that they would continue to be of great value even after this country has acquired an adequate system of industrial-continuation schools.